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would be allowed to graduate without a good understanding of some subject; and most of us would concede that it is worse for a graduate to be interested in nothing, than it would be for him to be interested in a subject in which he may not have been intended to be concerned.

As for his future, it will be possible for the student with capacity and opportunity for the highest personal development, to choose vocational work along another line, and his enthusiastic devotion to one subject and the sense of power that its mastery has given him will be an incentive to determined work in a new field. On the other hand, the student who lacks either opportunity or desire to change, will come out at a higher point when he has completed his professional course, than he would had he not acquired in his undergraduate years the power to do steady, intense, purposeful work.

For the headship of departments exalted almost to the position of constituent colleges of a university, it would be necessary to find men of liberal education as well as sound scholarship in a single field, men who could give character and vitality to a department, who could make themselves felt through their instructors, who could impart to students an enthusiasm for work so deep-seated as to enable them to withstand the lure of other departments when interest in familiar work was brought into competition with the charm of initial knowledge in fresh fields. To find the right men for the top places would be difficult, but it is not so impossible as to provide dormitories with successful proctors of the elder-brother type. The head professor would work under conditions most favorable. He would have large authority. The student coming to him in the spirit of willing discipleship predisposed to find his chosen leader wise and right, would receive instruction with open mindedness and respond quickly to suggestion. By limiting his teaching to the students belonging to his own department, the professor could know the stimulus of working in an atmosphere of scholarly concentration with men seriously sharing his interests, an

atmosphere sure to promote that most elevating of human relationships, the impersonal comradeship of those who have sunk sense of self in a common quest. Even granted added work for the head professor, he might in the end count himself a gainer through his enlarged responsibility.

F. M. PERRY

#### QUOTATIONS

##### SECONDARY EDUCATION IN AGRICULTURE IN THE UNITED STATES<sup>1</sup>

AGRICULTURE, including horticulture and forestry (and it is well to bear in mind that where I use the term agriculture I would use it in the ordinary sense to include the whole subject), should be a regular part of public secondary education; (2) the unity of the educational system should be maintained, but there should be sufficient elasticity of curricula to meet the various needs of the people; (3) the standard curriculum of secondary schools having agricultural courses should conform in a general way to that adopted for the general school system of the state; (4) the standard agricultural courses, whether in the ordinary high schools or in special schools, should not be narrowly vocational, but should aim to fit the pupils for life as progressive, broad-minded and intelligent men and women, as well as good farmers and horticulturists; (5) the standard courses in agricultural secondary schools should be so organized as to form a natural and proper preparation for entrance to agricultural colleges.

The conditions of entrance requirements to colleges are, in my judgment, far from satisfactory. It is not likely that we have reached the ultimate plan for the preparation of the great mass of students who in the future will desire college courses. It seems certain that when the so-called vocational subjects are properly organized and taught in the second-

<sup>1</sup> From an address by A. C. True, director Office of Experiment Stations, before the Association of American Agricultural Colleges and Experiment Stations at Portland, Ore., August 18, 1909, and adopted by the association as containing a statement of principles which it approves regarding secondary education in agriculture.

dary schools they will be generally recognized as having much pedagogical value. This is especially true of agriculture, which is a subject embracing much of the general human interest. Even under present conditions the agricultural colleges would do well to give credit in their entrance requirements for agricultural subjects properly taught in secondary schools.

The agricultural college should have a definite legal relation to our public school system, and especially to the courses or schools of agriculture of secondary and elementary grades. By this I mean that the state legislatures should take definite action recognizing that agricultural colleges have a definite function to aid in the organization of a proper system of secondary instruction in agriculture, and help the secondary schools in that work.

One difficulty now in the progress of this movement is that in quite a number of states the legislation is such that the agricultural colleges, if they take any part in it, have to "butt in." The whole matter of secondary education is in many states intrusted to the state department of education, as far as the state deals with the matter. I think that ought to be remedied. It may be said that that is only part of a wider thing. I do not believe that we have yet in this country considered definitely enough the proper relation of our universities and colleges to the more elementary education. These higher institutions in many states yet stand too much apart from our general system of education. It is very desirable, it seems to me, that they should be recognized by statute everywhere as an essential part of our system of public education. And while that general movement is proceeding the friends of agricultural education should urge that the agricultural colleges should have a definite part in the organization and maintenance of systems of agricultural education in the public schools.

Agricultural colleges will have to do secondary work to a considerable extent for some time to come. We can not, in my judgment, jump immediately in all our agricultural col-

leges to a state of things where all the secondary work is excluded. This should, however, be definitely organized as separate and distinct from the college work. The aim should be to have all secondary work relegated to secondary schools, entirely separate from the colleges, when such schools are efficiently organized with reference to instruction in agriculture.

Agriculture should be generally introduced into the ordinary high schools. There should also be a limited number of special agricultural high schools in the different states. These should be so limited in number that they will be organized with reference to large districts. I do not believe it is either necessary or desirable to organize such schools with the county as the unit. Experience so far points to the fact that the county is too small a unit for the proper equipment and maintenance of a thoroughgoing agricultural high school. These special schools have a relatively large agricultural faculty and an adequate equipment, so that students going to them will not only have offered to them a standard course of high school or secondary grade, but will also have opportunity to specialize to a certain extent along different agricultural lines. I believe that such schools are needed, because they will in a way set the pace for secondary education in agriculture, and will help rather than hinder the general introduction of agriculture into the ordinary high schools. Besides serving more general purposes, they will attract a good many of the more mature students, who are not ready or financially able to go to college, but desire to go somewhere to get some definite instruction in agriculture, and who are really too old to feel comfortable in the ordinary high school. These schools will also aid in the preparation of teachers and school officers for the rural schools; so that in a way these special agricultural schools will more fully meet the need which is now being met to a limited extent by the special and short courses in the agricultural colleges.

In speaking of this subject, we must, of course, all the time remember the great extent

which this movement will have when once it is in complete operation. It is a comparatively easy matter now for the colleges to take care of this short-course work and a considerable amount of secondary work, because the number of students so far have been comparatively limited in each state. But as we approach the time when we are to have half a million students in agriculture in secondary schools it is going to be a very different proposition. In the near future the colleges will have all they can do to take care of the students in regular college courses in agriculture. The special agricultural schools will fill a great need by attracting the more mature students who would not go to the ordinary high schools, and the ordinary high schools will have plenty of agricultural students of proper high-school age.

As I said, I believe the standard courses in these special agricultural schools should not be narrowly vocational, but should conform, in a general way, to the general standard for the high-school system in the state, and they should be organized so as to connect them definitely with the general educational system of the state. To do this it will probably be found necessary in the case of schools that have shortened the school year to twenty-four weeks of six days each, instead of thirty-six weeks of five days each, to add another year to the standard course, making it five years instead of four. But it would be desirable that besides the standard courses which would prepare the student for college or for life, as the case might be, such schools should have shorter courses more purely vocational.

#### SCIENTIFIC BOOKS

*Experimentelle Untersuchungen über Atomgewichte.* Von THEODORE WILLIAM RICHARDS und seinen Mitarbeitern. Berlin, 1909.

In this fine octavo of 890 pages, Professor Richards has brought together, in German translation, the many papers upon atomic weights which, during the past twenty-two years, have been published by him and his collaborators. These researches are already

well known to all chemists who are interested in the accurate determination of these fundamental constants, and the results obtained have received very general acceptance. Their collective publication, however, is highly suggestive, and deserves a careful review.

The first of these researches, that upon the atomic weight of oxygen, was carried on by the late Professor J. P. Cooke, with the co-operation of his then student, Richards. The latter began his independent work with a revision of the atomic weight of copper, which was followed by papers upon barium and strontium. Afterwards, Professor Richards had the assistance of his advanced students, and with their aid the atomic weights of zinc, magnesium, nickel, cobalt, iron, uranium, calcium, caesium, sodium, chlorine, potassium, nitrogen, sulphur and silver have been redetermined, and apparently with the greatest possible accuracy. There is no reasonable doubt that the work done has been a great advance upon all previous investigations of similar purport; but as Professor Richards would himself admit, it is neither final nor absolute. Our knowledge of physical constants is obtained by what may be called a method of successive approximations; but absolute accuracy is unattainable. The researches now before us represent, in all probability, the closest approximations to the truth as yet reached, but that statement does not imply the impossibility of future improvement. Such improvements are likely to be small, however, and to affect only the minor decimals.

In reviewing the work so far done, one can not help noting the steady advance in experimental technique. The later determinations appear to be of a much higher order than the earlier ones. Indeed, several of the papers in the volume are devoted to improvements in manipulation, or to the exposure of constant errors against which the investigator must be always on his guard. The bottling apparatus in which materials are prepared for weighing, and the nephelometer by which mere traces of precipitates are recognized, represent improvements in apparatus. The purification of